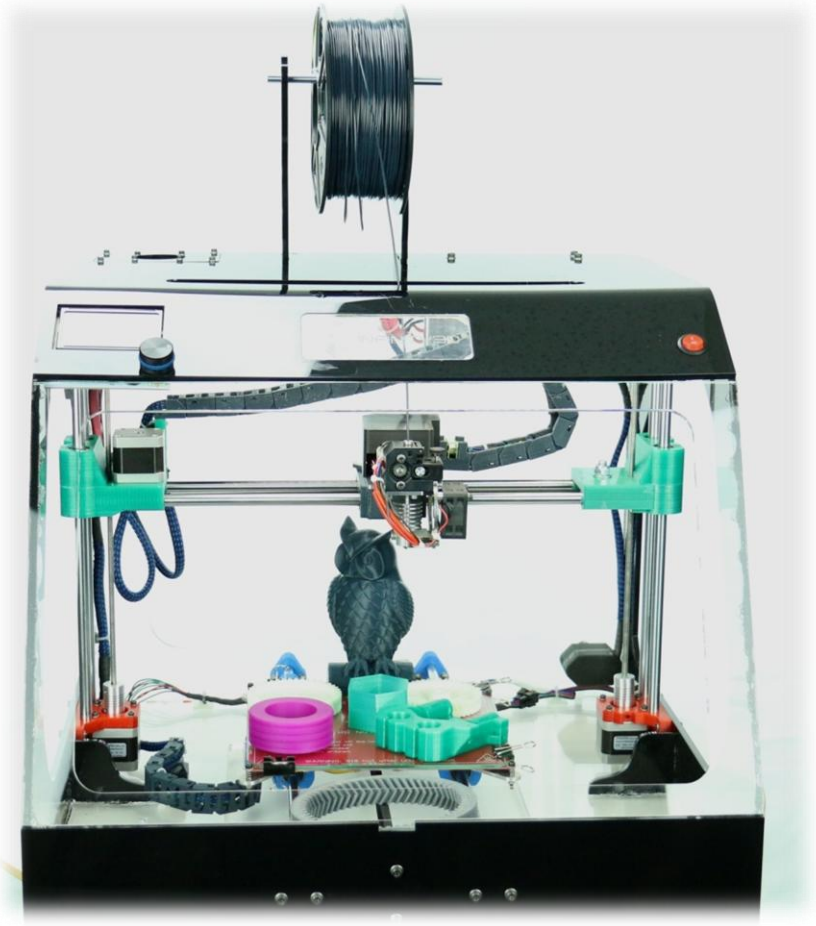
Revolution 3D Printers

INFINITY 3D

Operations Guide



Specifications

Printer Style

- FFF(Fused Filament Fabrication)
- Cartesian Robot
- Open Frame

Printing

- Print Surface: Heated bed
- Print Area: 215mm x 215mm x 220mm (8.5in x 8.5in x8.7in)
- Print Volume: 10,170cm^3 (625 in^3) of usable space
- Top Print Speed: 100mm/sec (4.1in/sec)
- Print Tolerance: 0.1mm (0.0039in) in X and Y axes. Z axis is dependent on layer thickness
- Layer Thickness: 0.075mm to 0.35mm (0.003in - 0.0138in)
- Supported Materials: ABS, PLA, HIPS, PVA, and wood filaments
- Usable Filament Sizes: standard 1.75mm (0.068in)

Physical Dimensions

- Overall Dimensions: 520mm x 550mm x 480mm (20.5in x 21.6in x 18.9in)
- Weight: 11kg (24.25lbs)

Electrical

- Power Requirements: 110 - 220 VAC
- Temperature: Maximum operating temperature (Extruder), 315C (600F)
- Temperature: Maximum operating temperature (Heated Bed), 110C (230F)

Operations Manual

INFINITY 3D Operations Manual by Revolution 3D Printers
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Published by Revolution 3D Printers, Victoria, BC
For more information, call +1-877-269-5510 or go to www.Revolution3DPrinters.com

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Warning

READ THIS MANUAL COMPLETELY BEFORE UNPACKING AND POWERING UP YOUR PRINTER.

Safety Information

Caution: Do not reach inside the INFINITY 3D printer while it is operating, and always allow for the heated parts to be fully cooled after operation. The INFINITY 3D printer generates high temperatures and has moving parts that may cause injury.

WARNING: BURN HAZARD
HOT SURFACE
ALLOW COMPONENTS AND FILAMENT TO FULLY COOL BEFORE HANDLING

WARNING: VAPORS/FUMES
VAPORS/FUMES MAY CAUSE IRRITATION AT OPERATING TEMPERATURES. OPERATE IN A WELL VENTILATED AREA
NEVER PLACE FLAMMABLE MATERIALS OR LIQUIDS ON OR NEAR THE PRINTER WHEN POWERED OR IN OPERATION

WARNING: MOVING PARTS CAN CRUSH/CUT
ALWAYS KEEP HANDS CLEAR WHILE OPERATING
TIE BACK LONG HAIROR CLOTHING THAT CAN GET CAUGHT IN THE MOVING PARTS OF THE PRINTER.

WARNING: DO NOT OPERATE UNATTENDED
DO NOT LEAVE INFINITY 3D PRINTER UNATTENDED DURING OPERATION

WARNING: ELECTRIC SHOCK HAZARD
NEVER OPEN ELECTRONICS CASE WHEN PRINTER IS POWERED ON. TURN OFF AND UNPLUG THE POWER SUPPLY

3D Printer Software

Software Overview

Revolution 3D Printers, makers of the INFINITY 3D printer, completely supports free/libre hardware and software. Along with the INFINITY 3D being a free/libre hardware design, it has been tested to work with 100% free/libre software.

To operate your INFINITY 3D printer you will need to install a few software packages.

You will need

- Slicing Software to convert an .STL to .gcode machine language

It is optional to have

- CAD or 3D Modeling Software
- 3D Design Optimization & Repair software

Recommended software

MatterControl	**Required**	Printer Dashboard/slicer	Included with purchase
Slic3r	**Optional/Required for DPE**	Slicing Software	Free open source
GeoMagic	**Optional**	CAD 3D Modeling Software	Free trial version available
NetFabb Basic	**Optional**	Design Optimization & Repair	Free version available

The recommended software links can be found in the Support/Downloads section of Revolution3DPrinters.com

You can also find downloads, drivers and configuration files specific to the INFINITY 3D printer at Revolution3DPrinters.com. Your printer has been pre-loaded with the necessary drivers.

MatterControl

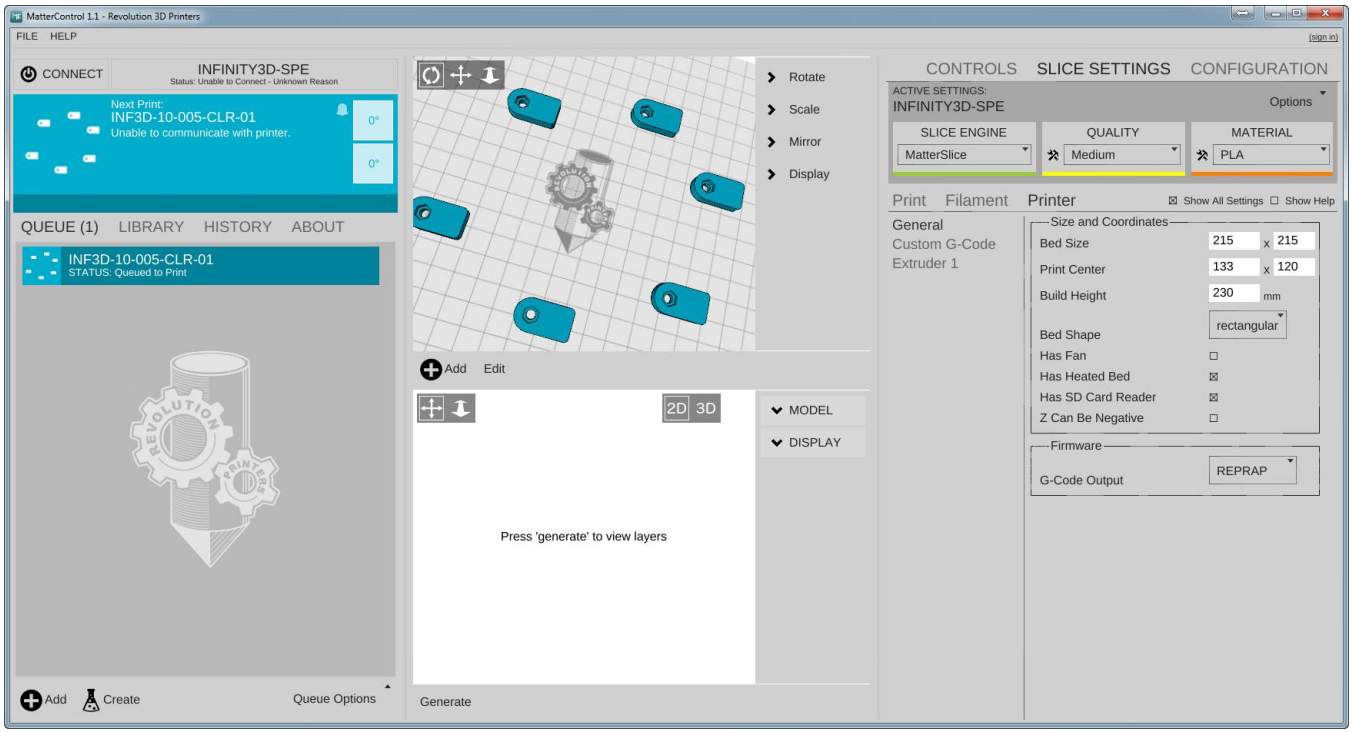

Figure 1 MatterControl

Website: http://www.mattercontrol.com

The slicing software is the first tool in the chain of 3D printing software. Slicing software uses commonly used .STL files to create .gcode files.

Gcode files contain instructions for the 3D printer on where, when, and how fast to make movements. This is where choosing the right slicing software to optimize your .STL, .OBJ or .AMF file for 3D printing becomes critical to successful printing.

Although the INFINITY 3D printer will work with any slicing software, we've chosen to highlight MatterSlice in the instructions of this operations manual.

The .STL file is a 3D model file that can be exported by all common CAD and 3D modeling software. The MatterSlice software then slices the .STL 3D model into layers and print paths to create a 3D printable .gcode file.

MatterSlice includes very simple settings that allow you to easily refine prints. You can create multiple configurations for changing printer setups including nozzle sizes and desired print resolution. For ease of use we have pre-defined three Quality Slice Settings and two Material settings in the MatterSlice program. These configuration settings will appear when you select the INFINITY 3D printer. We highly recommend starting with our pre-defined MatterSlice configurations for your initial prints.

Should you choose to use another slicing software you must include the following custom .gcode to the beginning of your slice file:

```
G90       ;absolute positioning
G28 X0 Y0  ;move X/Y to min endstops
G28 Z0     ;move Z to min endstops
G1 F900  Y60 ;move Y 60mm to miss the bed clip
G92 E0              ;zero the extruded length
G1 F200 E3          ;extrude 3mm of feed stock
G92 E0              ;zero the extruded length again
G1 F7800
M117     [input_filename_base]; what will be displayed during print
```

Include this .gcode at the end of your file:

```
M104 S0                 ;extruder heater off
M140 S0                    ; bed heat off
G91                       ;relative positioning
G1 E-1 F300                  ;retract the filament a bit before lifting the nozzle
G1 Z+0.5 E-5 X-20 Y-20 F{travel_speed} ;move Z up a bit and retract filament
G28 X0 Y0                 ;move X/Y to min endstops, so the head is out of the
way
M84                   ;steppers off
G90                   ;absolute positioning
```

CAD and 3D Modeling Software

Currently Revolution 3D Printers is not distributing any CAD or 3D modeling software packages. However, there are multiple free/libre software packages available. Other common non-free CAD and 3D modeling software are also capable of exporting the required .STL files. On some CAD and 3D modeling software you will need to select millimetres as the output unit. If possible it is best to build your 3Ddesign in metric units rather than imperial units. MatterSlice requires .STL files sized in millimetres. If an .STL with inches as units is loaded into the MatterSlice, the model will be scaled much smaller than expected. The software listed below outputs millimetres as the unit by default.

FreeCAD

Website: http://free-cad.sourceforge.net
FreeCAD is a great free/libre CAD application. Containing a full GUI for building CAD models, FreeCAD is capable of creating simple to complex designs. STL files can also easily be exported for use with 3D printing. FreeCAD is available for GNU/Linux, Windows, and Mac. The latest development version is recommended.

Blender

Website: http://blender.org
The most widely used free/libre 3D modeling software, Blender is well documented with tutorials available on the Blender.org website. Numerous video tutorials can be also found online.

Shapesmith

Website: http://shapesmith.net
Shapesmith is a web based 3D modeling software. This means there is no required software to get started designing models. Shapesmith is also a great choice for anyone just starting out in CAD/ 3D modeling.

OpenSCAD

Website: http://openscad.org
OpenSCAD is another free/libre CAD software; however, different than FreeCAD, it is script based. Rather than using a GUI to generate CAD designs, OpenSCAD CAD designs are created using script based renderings. Operators with programming experience would find this very useful. Also, OpenSCAD uses a simple script language that is easy to learn for operators with little or no programming experience.

Getting to know the INFINITY 3D Printer

Main Components Identification

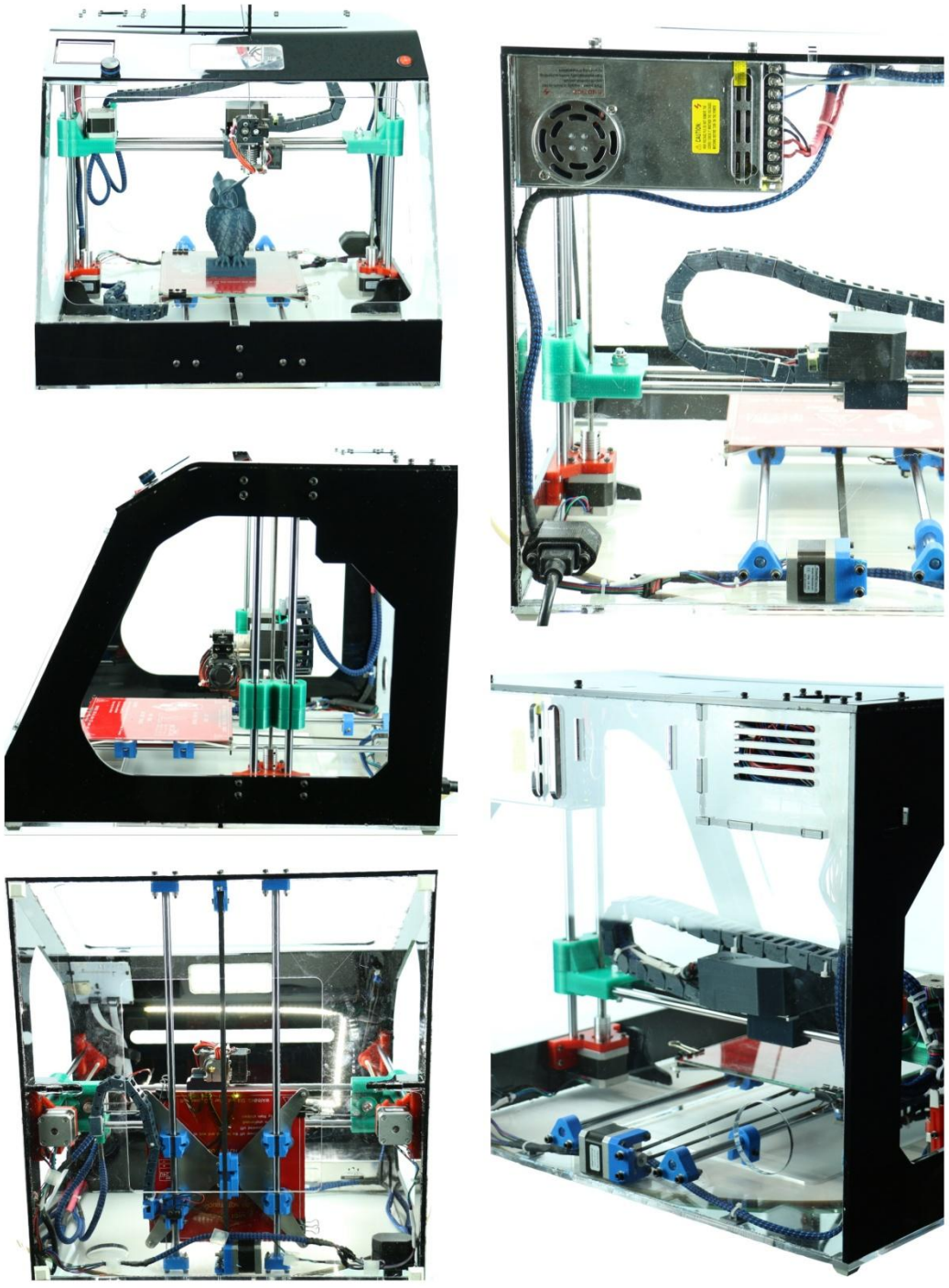

Figure 2 Main Components Identification

For a full components list, refer to the Illustrated Parts Catalogue.

Full Graphic Display/Control Panel

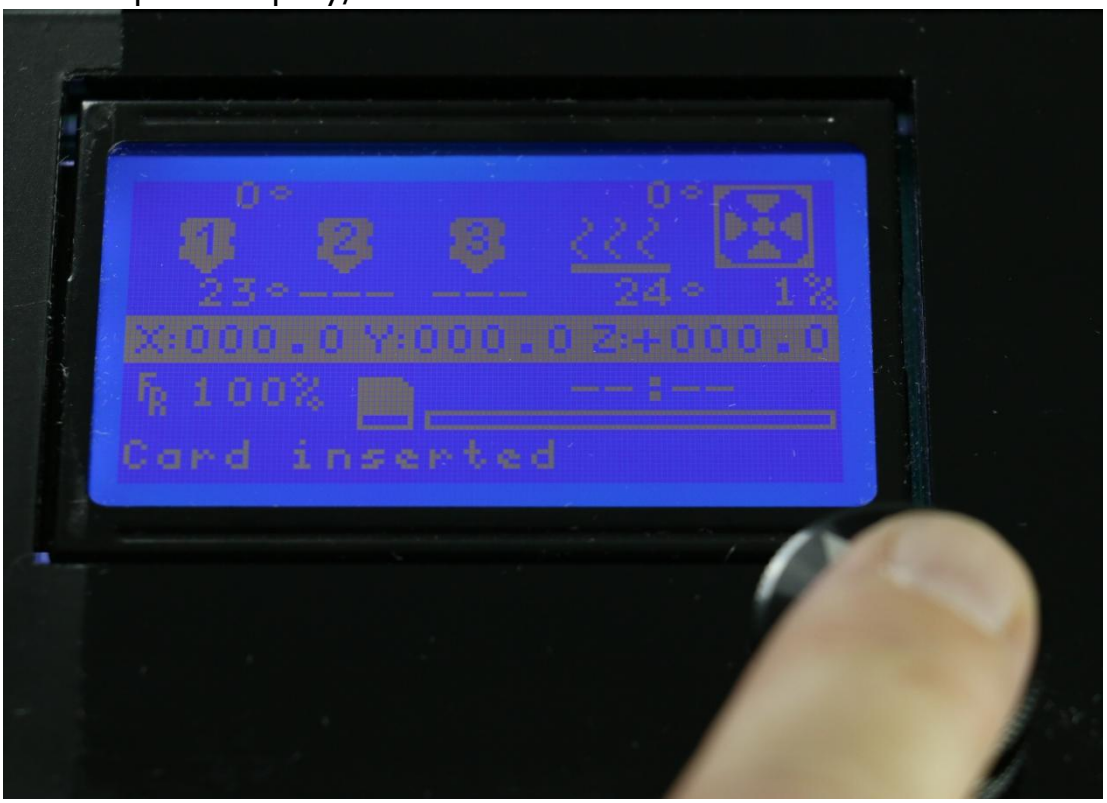

Figure 3 Full Graphic Control/Display Panel

The Infinity 3D Full Graphic Display/Control panel allows for untethered printing and thus eliminate the possibilities of a failed print due to the connection between a computer and the printer timing out or simply failing. The full graphic display/control panel also allows for many on the fly adjustments not available when using a tethered connection. For example, you are able to increase or decrease speed while printing using the Interface Knob. The control panel has a slot on the LH side for inserting the SDcard (or micro adapter card) that is required for untethered printing. Refer to the INFINITY 3D Quick Print Guide for use of the display/control panel for printing. The Main Menu can be accessed by pressing down on the Interface Knob and consists of the following:

- Main Start Up Screen
  - Info Screen
  - Prepare
    - Disable steppers
    - Auto home
    - Preheat PLA
      - Preheat PLA 1
      - Preheat PLA 2
      - Preheat PLA 3
      - Preheat PLA ALL
      - Preheat PLA Bed
    - Preheat ABS
      - Preheat ABS 1
      - Preheat ABS 2

- Preheat ABS 3
- Preheat ABS ALL
- Preheat ABS Bed
- Cool down
- Switch power off
- Move axis
  - Move 10mm
  - Move 1mm
  - Move 0.1mm

Control

- Temperature
  - Nozzle:
  - Nozzle2:
  - Nozzle3:
  - Bed:
  - Fan Speed:
  - Autotemp:
    - Min:
    - Max:
    - Fact:
  - PID-P:
  - PID-I:
  - PID-D:
  - PID-C:
  - Preheat PLA conf:
    - Fan Speed:
    - Nozzle:
    - Bed:
  - Preheat ABS conf:
    - Fan Speed:
    - Nozzle:
    - Bed:
- Motion
  - Accel:
  - Vxy-jerk:
  - Vz-jerk:
  - Ve-jerk
  - Vmax x:
  - Vmax-y:
  - Vmax-z:
  - Vmax-e:
  - Vmin:
  - Vtrav min:
  - Amax z:
  - Amax y:
  - Amax x:
  - Amax e:
  - A-retract:
  - Xsteps/mm:
  - Ysteps/mm:
  - Zsteps/mm:
  - Esteps/mm:
- LCD contrast
  - LCD contrast:
- Restore failsafe

Print from SD

- <list of the .gcode files on the SD card>

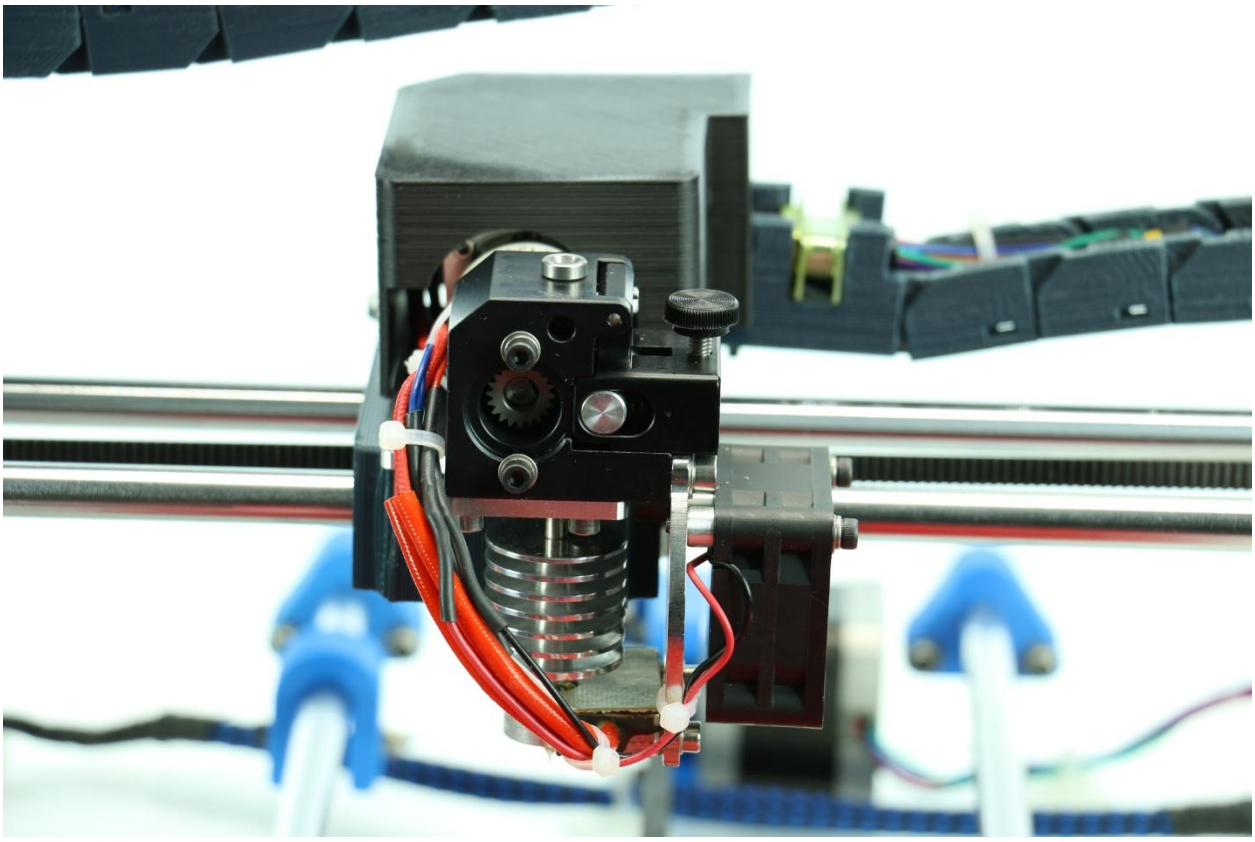

Figure 4 Single Professional All Metal Extruder

Single Professional All Metal Extruder

The INFINITY 3D printer incorporates many innovative features and well thought out parts designed to take full advantage of the Single Professional All Metal Extruder. The Infinity 3D fitted with the Professional Extruder can alleviate most of this frustration by simplifying the filament changing process by utilising an easy opening service door that offers continuous idler bearing spring preload adjustment using 2 set screws.

The extruder assembly features an innovative "all metal" hot end that features a detachable filament guide and nozzle module "DFGNM". This design ensures easy to change nozzles for a variety of filaments. As well as enabling you to work with polycarbonates at temps between 280-315 degrees Celsius and future materials that will require higher temperatures beyond what can be supported by other hot end designs.

The 1:13 geared Nema-12 stepper motor and stainless steel 303 hobbed gear offers another advantage for successful printing, it moves the heat of the motor from long print runs, away from the filament drive teeth.

Figure 5 Quick Disconnect Extruder Plug

The Professional Extruder utilises a D-Sub connector located on the rear of the extruder carriage assembly. This allows for the quick replacement of the extruder assembly by simply removing three screws and unplugging from printer.

Heated Bed

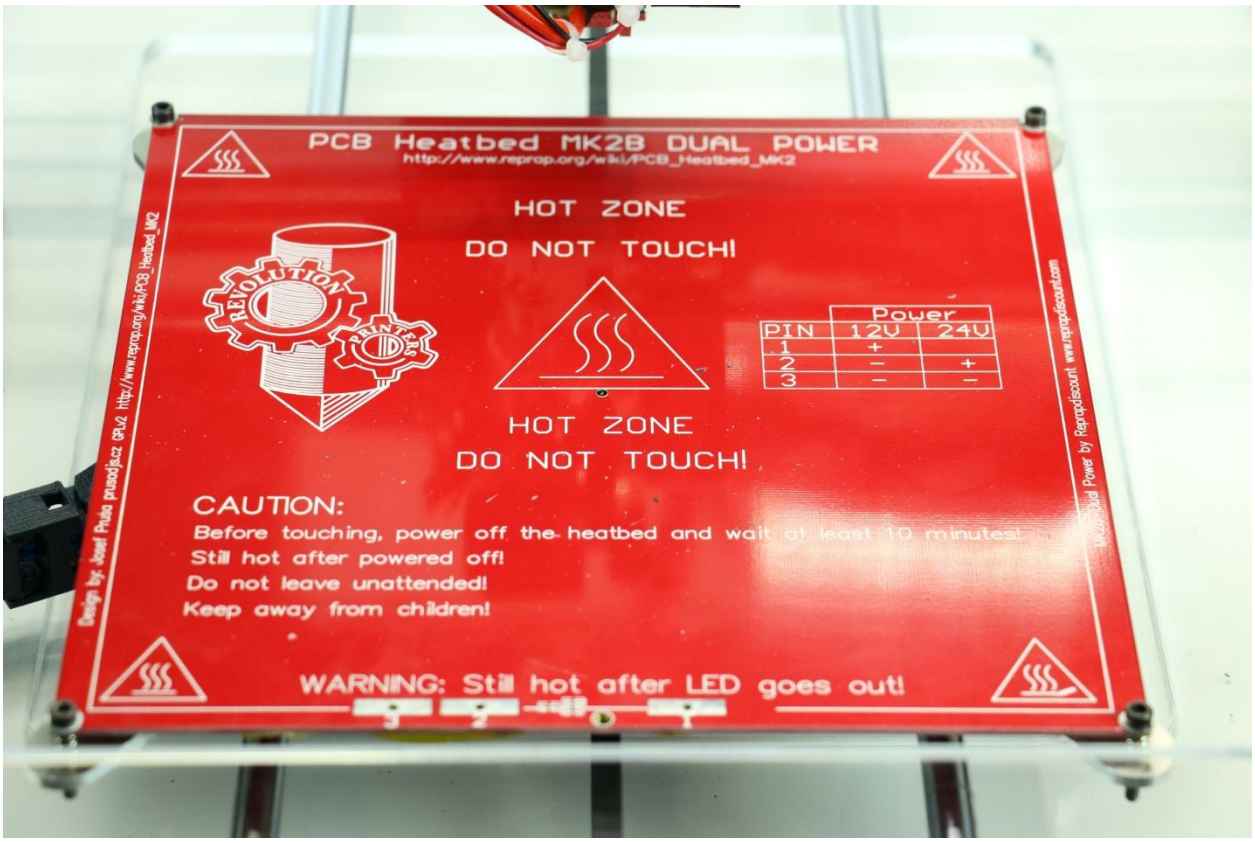

Figure 6 Heated Bed

The heated bed is essential to creating high quality prints by reducing warping and curling of the printed parts due to inconsistent cooling and shrinking. The heated bed is controlled by the power wires connecting the +/- to the RAMPS board and a thermistor controls when power is ON or OFF depending on the temperature selected by the operator.

Power Supply

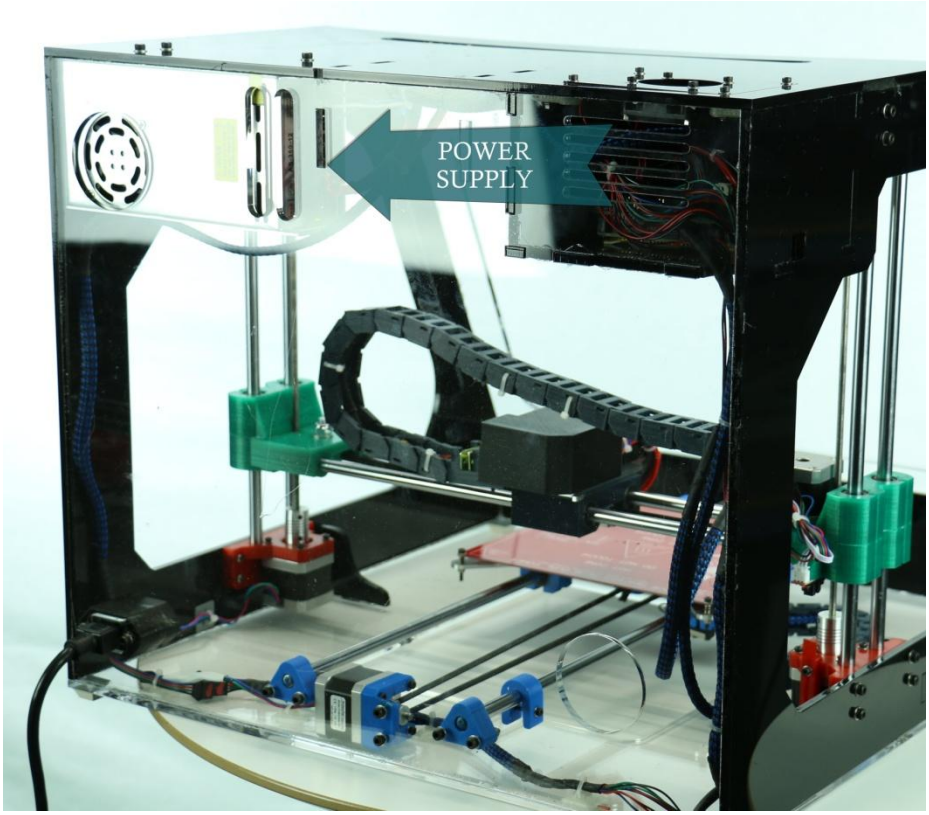

Figure 7 Power Supply

The Standard 12volt 30AMP power supply, mounted in the aft RH corner of the frame, provides the DC voltage required to operate the printer. The power supply is turned ON and OFF with a switch located on the front panel of the printer.

Figure 8 ON and OFF Switch

RAMPS Enclosure

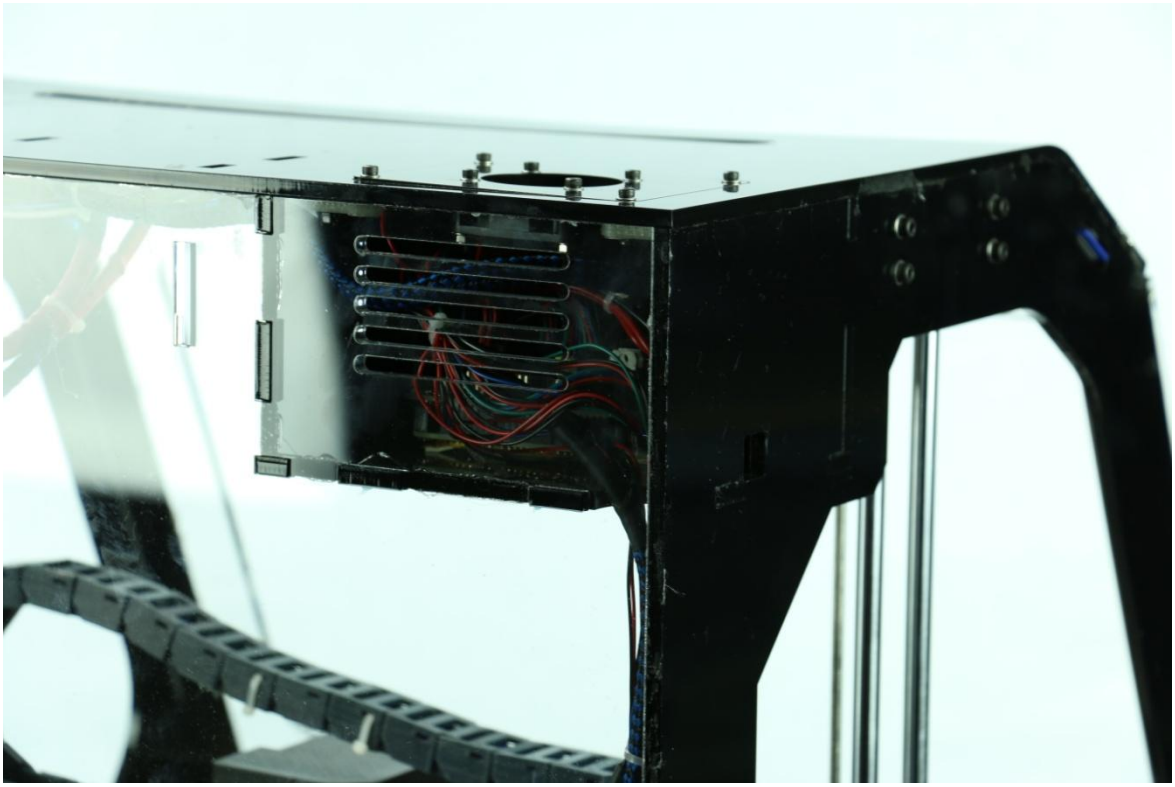

Figure 9 RAMPS Enclosure

The RAMPS enclosure, located in the aft LH corner, was designed to provide a convenient place to house all necessary electronics as well as provide proper cooling of circuitry to ensure trouble free operation. On the LH side of the printer there is an access hole, this is where the USB printer cable will plug into for tethered printing (running printer direct from computer) as well as connection to a computer for firmware updates. Always turn power off and unplug printer before opening the case cover. The cover has the cooling fan attached, care should be taken on removal that the wires are not stressed and on installation ensure correct polarity for fan plug. As with all the hardware that is installed directly into any plastic parts, use very little torque on installation.

Axis Identification - XYZ +E Cartesian Robot

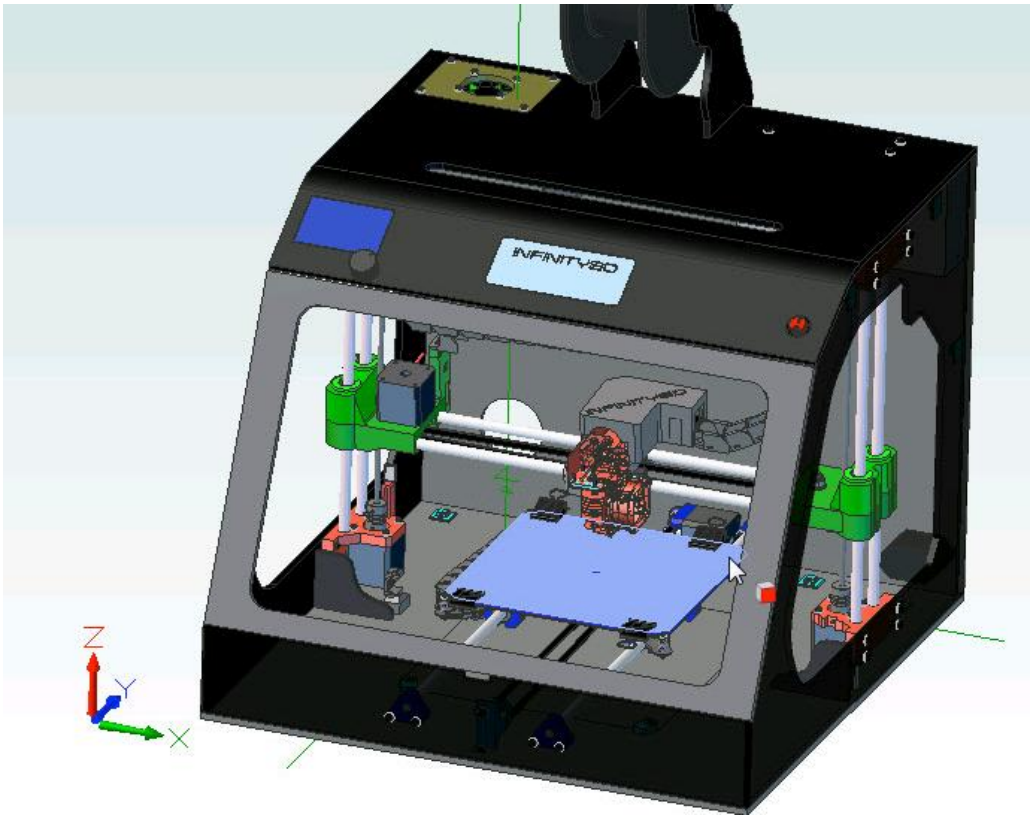

Figure 10 XYZ Cartesian Robot

The INFINITY 3D is a Cartesian robot, this means it moves in the XYZ axis in a linear manner. The E axis can be considered the tool head as it is the extruder motor which needs to be controlled to enable correct extrusion rates. Although not all CAD programs use the same color standards for the axis, Revolution 3D Printers opted to use the most common Green for the X-Axis, Blue for the Y-Axis and Red for the Z-Axis with Yellow as the E(xtruder) axis. This color co-ordination standard is important as throughout the Infinity 3D printer and these manuals it is used to quickly and easily identify harness connections and parts. This is evident in the part colors for the different axis parts.

Limit Switch Locations

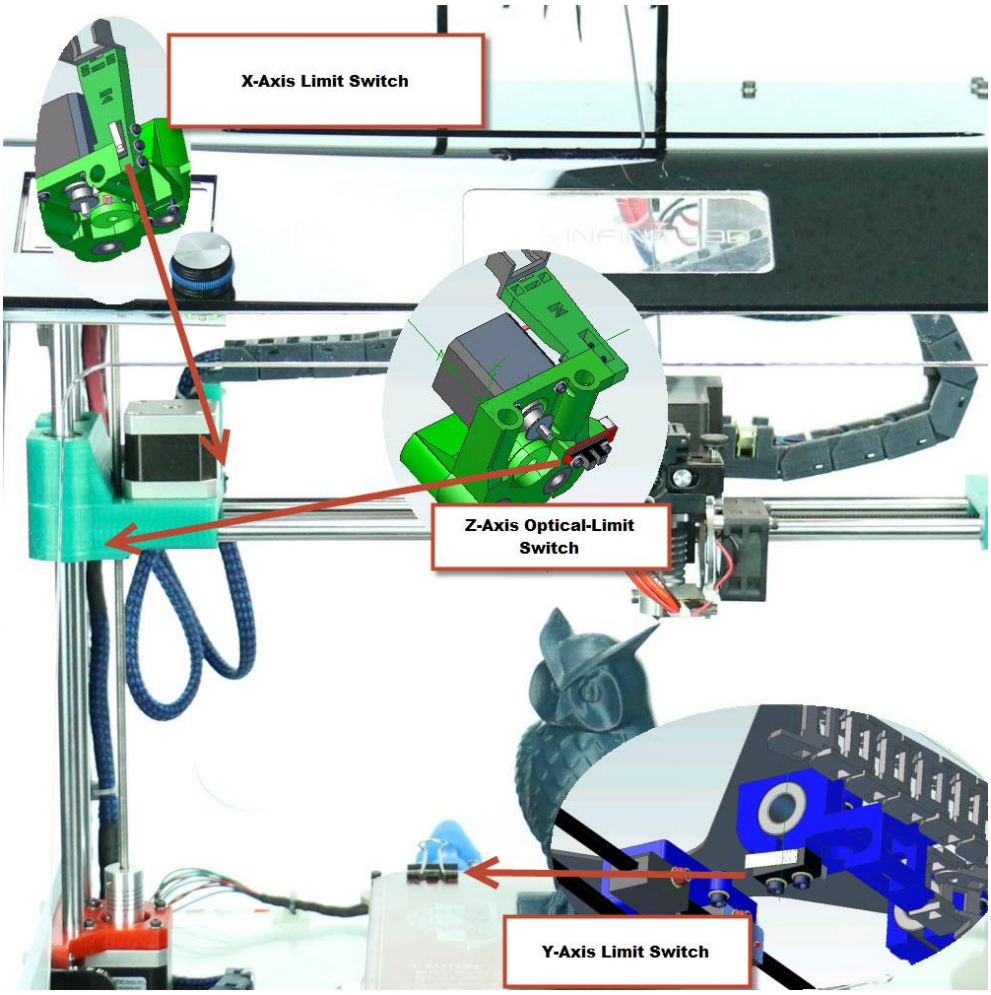

Figure 11 Limit Switch Locations

Mechanical limit switches are strategically located to both aid in keeping the wiring clean as well as to provide the least possibility of interference and trouble.

The X-Axis Limit switch is located on the X-Axis motor mount and is activated by the tab on the aluminum extruder mount plate. This stop is not adjustable.

The Y-Axis Limit switch is located under the bed and is attached to the Linear Bearing fitting on the LH back side, the stop located on the linear rod is adjustable.

Unlike the X and Y, the Z Axis Limit is an optical switch to provide extremely accurate and repeatable limit location, alleviating the need for constant adjustment and failed prints due to incorrect height adjustment. The Z-Axis stop is attached to the back side of the LH Z-Axis motor mount. The stop for the Z-axis is adjustable to accommodate varying sizes and lengths of hot ends, bed build plates or styles of extruders/tool heads. The initial starting height when printing is critical to successful printing, and is covered in further detail in Calibration, Alignment and Tuning.

The Important First Layer

Before you start the first print it is worthwhile to talk about the importance of getting the first layer right. As many have found through trial and error, if the first layer is not the best it can be then it can lead to complete failure, parts detaching, and warping. There are several techniques and recommendations to follow in order to minimise the chance of this happening.

Proper filament extrusion

Before starting your print, make sure that the filament is able to flow through the hot end of the extruder without any plugs or dust in the way. The same goes for the filament feeder, blow out any dust or filament particles to ensure smooth extrusion. Refer to the Quick Print Guide on how to properly set up filament before every print.

Level Bed

Having a level bed is critical. If the distance between the nozzle tip and the bed deviates by even a small amount it can result in either the material not lying down on the bed (because the nozzle is too close and scrapes the bed instead), or the material lying too high from the bed and not adhering correctly. Make sure to change the level of the bed if you go between using blue painters tape and hairspray as the blue painter's tape adds to the height of the bed. Refer to the Bed Levelling section in Maintaining Your Printer.

Higher temperature

The extruder hot-end and bed, if it is heated, can be made hotter for the first layer, thus increasing the viscosity of the material being printed. If you find that your filament is not adhering, even after printing a "skirt", try increasing the extruder multiplier or increasing the temperature. As a general rule, an additional 5°C is recommended.

Lower speeds

Slowing down the extruder for the first layer reduces the forces applied to the molten material as it emerges, reducing the chances of it being stretched too much and not adhering correctly. 30% or 50% of the normal speed is recommended. Speed can also be increased or decreased during the printing process using the interface knob and display/control panel, or the speed multiplier in MatterControl.

Bed material

There are many surface adhering options out there, and preparing the right surface can vastly improve first layer adhesion. For most filaments, a light coat of an adhesive such as hairspray works well. If hairspray doesn't work, for PLA, use PET, Kapton, or blue painters tape. For ABS, use PET, Kapton tape with an ABS/acetone glue.

ABS/Acetone Glue

Acetone is not included or required for the INFINITY 3D printer.
Acetone can cause skin irritation when prolonged skin contact occurs. It is recommended to use acetone safe gloves when applying the ABS/acetone glue. Use the ABS/acetone glue in a well-ventilated space. Leave the mixture bottle closed except when applying to the bed. Acetone liquid and vapours are highly flammable. Keep acetone away from open fames and high temperature sources, including the 3D printer. Read the warnings label on your purchased acetone packaging for additional warnings.

Using an HDPE acetone safe bottle 200ml, fill the bottle 3/4 full with acetone. Now cut eight, 75mm lengths of ABS filament and put them in the bottle with the acetone. Allow the ABS filament to dissolve for 4-6 hours.

When applying the acetone/ABS mixture it will work best when the bed temperature is below 60C. To apply the acetone/ABS mixture use an acid brush or similar and brush onto the cool print surface to apply a thin layer of ABS. Generally only one thin layer of the acetone/ABS solution is needed. However, if needed you can apply multiple coats.

Maintaining Your 3D Printer

There is little maintenance needed in keeping your INFINITY 3D printer running. Depending on your rate of use you will want to perform a quick check of your printer every 2-4 weeks. The following maintenance guide lines will keep your printer printing quality models.

Bed Levelling

The INFINITY 3D is completely assembled, calibrated and fine tuned so that you can start printing right away. The bed levelling should not be disturbed as it is set using very accurate equipment. Just in the case that the bed requires re-levelling, such as movement during shipping, ensure you follow these instructions step by step for best results:

1. Use the X-Axis levelling block provided in the tool kit. This block is used to ensure that both the left and right sides of the x-axis assembly are referenced (levelled) to the same height.
2. Level the x-axis by raising it using the Full Graphic Display/Control panel by selecting prepare and then move axis until you can insert the block between the top of the z-axis motor mount and the bottom of the x-axis mounts, leave approximately 2-3 mm clearance between your block and the bottom of the x-axis motor mounts on each side.
3. Now by manually turning the z-axis threaded rods counter-clockwise lower each side until they just contact your levelling block. Ensuring this is done accurately on each side will give you the best end results.
4. **DO NOT move the z-axis motors manually from this point on.**
5. With the x-axis now levelled, using the graphic/control display, select "auto home" to get the axis motors to move in unison to their home positions.
6. **DO NOT move the z-axis motors with the panel until levelling is complete.**
7. Select "Disable steppers" in the display menu.
8. Use the bed height calibration card provided in the tool kit for the following adjustments.
9. When the distance between the build surface and the clean nozzle tip is correct the calibration card tool will slide under with a slight bit of resistance.
10. Manually position the nozzle above one of the corners as close to the build plate securing clip as possible.
11. Now check the clearance between the build surface and the nozzle tip with the calibration card.
12. Use the provided wrench and allen key to adjust the levelling screw nearest to the nozzle until this clearance is achieved.
13. Repeat steps 7-13 for each corner. Recheck all clearances until they all match.

    Note: **If** you are unable to or run out of spring pressure on the levelling springs start by tightening the spring screws until 6-8 threads are visible past the locknut or until any point of the heated bed just contacts the bed mount

plate. Adjust the coarse adjust Z-Axis stop by moving it up or down until the nozzle has a clearance of approx 2-3 mm from the build plate. You will need to "Auto home" each time you make an adjustment. You may need to "Auto home" a few times if you make an adjustment upwards.

14. Repeat Steps 6-14 to level each corner.

Smooth Rods

Wipe the smooth steel rods with a clean rag or paper towel. The linear bearings require very little lubricant. Apply a small amount of lightweight oil using needle oiler directly to the rods.

Threaded Z-Axis Rods

Place a small amount of oil from needle oiler on the threaded rods to lubricate the internal nut located in the x-axis mounts.

Hot End

The hot end should be kept clean of extruded plastic by removing melted plastic strands with the tweezers. If melted plastic builds up on the hot end nozzle it can be cleaned by gently scraping with tweezers all plastic while hot end is hot.

Electronics

The electronics case holding the RAMPS board may need to have dust blown out occasionally. Power down the printer and use the provided 2.5MM driver to remove the 4 M3 screws holding the lid to the enclosure. The fan is mounted to the lid and connected to the Fan Extender board. Be careful with the fan cable during removal. Once removed use short bursts of compressed air to blow out any dust or debris. Plug in the lid fan paying attention to polarity and reattach the lid.

Changing nozzles

The INFINITY 3D printer ships with a standard 0.35mm nozzle size Hot-End which allows small layer resolution and up to 0.35mm layers. Although the 0.35mm nozzle will be perfect for most printing applications Revolution 3D Printers also offers smaller and larger nozzle sizes.

Support

For common technical support questions for your INFINITY 3D printer visit Revolution3DPrinters.com

If you have further questions,

For Technical Assistance call: 1-877-269-5510, ext 2
Email: support@revolution3Dprinters.com

Please completely read this manual before contacting for support questions or help.